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Can videogames improve balance in women over 60 years?
¿Pueden los videojuegos mejorar el equilibrio en mujeres mayores de 60 años?

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Abstract. Objective*:* The aim of this study was to measure the usefulness of incorporating videogames as a physical activity training program for women above 60 years old. Methods: An intergroup, intragroup and multigroup design on three groups were used as well as experimental methodology. Women above 60 years old (N=43, age=67.74 ± 5.03 years), completed a proprioceptive and resistance training during three months and three sessions a week. Participants were divided into: control group (CG) (n=11; age=67.09 ± 6.25 years), does not do the experimental training. Experimental group 1 (EG1: N= 16; age= 66.94 ± 4.14 years) performed a proprioceptive and resistance training program of 40 minutes, adding the use of a videogame during 20 minutes. Experimental group 2 (EG2) (N=16; age=69.00 ± 4.99 years), performed the same training without the videogame training. Results*:* We found an improvement in EG1 in body fat, balance with and without vision, dominant hand isometric force and VO_2max. The EG2 group improves in body mass index (BMI), body fat, non-dominant hand isometric force and VO_2max. CG does not change. Conclusion: Joining a physical training program, including proprioceptive and aerobic resistance exercises result in a weight and BMI drop, and a VO_2max improvement in both groups (EG1 and EG2). Additionally, if the training program is completed with the use of videogames (EG1), monopodal static balance improve more than EG1 and EG2, with and without vision, which is considered beneficial to prevent falls in women over 60 years.

Keywords: Women, Quality of living, Training program, Balance, Videogames.

Resumen. Objetivo: El objetivo de este estudio fue evaluar la utilidad de incorporar videojuegos en un programa de actividad física en mujeres mayores de 60 años. Método: Se diseñó un estudio intergrupal, intragrupo y multigrupo, así como una metodología experimental. Se implementó un entrenamiento de resistencia y propiocepción en mujeres mayores de 60 años (N=43, Edad=67.74 ± 5.03 años, durante tres meses y tres sesiones semanales. Se dividió en un grupo control (GC) (n=11; Edad=67.09 ± 6.25 años), no realizó entrenamiento. Grupo experimental 1 (GE1) (GE1: N= 16; edad= 66.94 ± 4.14 años), realizó un entrenamiento de resistencia y propiocepción y se añadió el uso de videojuegos durante 20 minutos. Grupo Experimental 2 (GE2) (N=16; edad=69.00 ± 4.99 años), que realizó el mismo entrenamiento sin el uso de videojuegos. Resultados: Encontramos una mejora en el GE1 en grasa corporal, equilibrio con y sin visión, fuerza isométrica en la mano dominante y VO_2max. El GE2 mejoró en el índice de masa corporal (IMC), grasa corporal, fuerza isométrica en la mano no dominante y VO_2max. No se encontraron cambios en el GC. Conclusión: La inclusión en un programa físico de entrenamiento que incluye propiocepción y ejercicios aeróbicos de resistencia reduce el peso, el IMC y el VO_2max en ambos grupos (GE1, GE2). Además, si el programa de entrenamiento es completado con el uso de videojuegos (GE1), se mejora el equilibrio estático monopodal, con y sin visión, lo cual es considerado beneficioso para prevenir caídas en mujeres mayores de 60 años.

Palabras clave: Mujeres, Calidad de vida, programa de entrenamiento, Equilibrio, Videojuegos.

Introduction

An unprecedented rise of people above 60 years old can be seen in current society, predominated by the female gender (Horne, Skelton, Speed, & Tood, 2014). On a global level, this segment of the population is growing faster (Flack, Davy, Hulver, Winett, Frisard, & Davy, 2011), estimating that 29% of the global population will be above 60 years in 2025 (Rahman, 2007). The quality of life of this group may be impaired due to multiple factors such as sarcopenia. Sarcopenia is one of the factors that can increase functional difficulties in older people (Ruthig, Chipperfield, Newall, Perry, & Hall, 2007). Cases exist of people with total mobility becoming extremely immobile such as people who suffer from encephalic vascular accidents, disabling injuries, or immunological diseases. Other people show a progressive deterioration due to chronic illness as it is

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the case of osteoarthritis, neoplastic diseases, cardiac and respiratory failure or cognitive diseases like Alzheimer's (McNaull, Todd, McGuinness, & Passmore, 2010).

Walking ability can decrease due to falls and frequent hospitalizations (Scheffer, Schuurmans, Van Dijk, Vand der Hooft, & De Rooij, 2007). Also, falling is a public health problem (Blank et al., 2011), as constitutes the main cause of the accident from 60 years of age and it might even have fatal consequences for elder over 80 years (Meisler, et al., 2011). Every fall can produce muscle-skeletal injuries and a loss of confidence in older people to perform daily activities. Nowadays, there is no agreement about the causes of falls, but some authors concluded that it is a consequence of several aspects, as intrinsic to the own person as related to the environment (Caicedo, Reginfo, & Rodríguez, 2016; Hill, Nguyen, Shaha, Wenzel, Deforge, & Spellbring, 2009). The knowledge of these aspects allows us to design intervention and prevention strategies to decrease their consequences. In that sense, it is necessary to promote research about health and ageing related diseases to improve the quality of life in older people (Jin, Simpkins, Ji, Leis, & Stambler, 2015). During the ageing process occurs an involution in their physical condition, sharply manifested by a decline in physical basic capabilities as strength, cardio-respiratory capacity, flexibility, coordination, balance and body composition (Hernandez, Goldberg, & Alexander, 2010; Shields, Tremblay, Laviolette, Craig, Janssen, & Gorber, 2010).

There is a 27% of people over 65 years who have a high probability of falling off at least once a year, with a high likelihood of falling again after the first fall (Ganz, Bao, Shekelle, & Rubenstein, 2007). Approximately 50% of the falls occur at home, and can cause fractures, internal bleeding, pneumonia, soft tissue injuries, loss independence, among other consequences (González, Marín, & Pereira, 2001). One of the most useful strategies for preventing falls is to improve the physical capacities in the elderly (Horne et al., 2014). Moreover, it has been concluded that physical activity leads to improve cognitive functions of the elderly. Also, it can help to reduce the risk of suffering neurodegenerative diseases such as Alzheimer's (Ramos, Romero Ramos, & González Suarez, 2021). In addition, physical exercise helps to reduce or mitigate the decline of physical capacity in older adults, and therefore, to improve their level of independence (Misic, Valentine, Rosengren, Woods, & Evans, (2009), to reduce the risk of falling (Sherrington et al., 2017) as well as to prevent the possibility of injury and premature death (Chakravarty, Hubert, Lingala, & Fries, 2008). Heredia, Rodríguez, & García (2021) concluded in their research that regular practice of physical activity can lead to improvements in a physical level, health and quality of life of the older people.

Active ageing should be promoted since it can avoid the consequences of functional losses (Ory, Smith, Wade, Mounce, Wilson, & Parrish, 2010). However, the lack of adherence to physical programs hampers the improvement in the physical condition and consequently abandonment of the training programs (Schwenk, Jordan, Honarvararaghi, Mohler, Armstrong, & Najafi, 2013; Simek, McPhate, & Haines, 2012). Physical activity programs can be supported by conventional and technological activities (Paterson & Warburton, 2010). In fact, previous research has concluded that videogames can help improving the concentration in daily life activities and balance (Santamaría, Salicetti, Moncada, & Solano, 2018).

Physical exercise based on technological devices seems more common in teenagers (Epstein, Beecher, Graf, & Roemmich, 2007). It is less common to use in older adults, due to the technological gap that exists between them. It should lead to improving the quality of life since recent research have concluded that digital games help improve physical and cognitive function in older adults (Zhang & Kaufman, 2016; Salazar, Villar, Párraga, & Moreno, 2010). Hence, videogames could be a positive support when our objective is to improve physical and cognitive function (Anguera, Gazzaley, Sahakian, & Kramer, 2015; Ballesteros, Prieto, Mayas, Toril, Pita, Ponce de León, Reales, & Waterworth, 2014; Horne et al., 2014; IJsselsteijn, Nap, De Kort, & Poels, 2007; Shah, Weinborn, Verdile, Sohrabi, & Martins, 2017). Also, it can be used in neurorehabilitation programs (Cameirão, Badia, Oller, & Verschure, 2010); like in the improvement and recovery of pathologies such as minor depression (Li, Theng, Foo, & Xu, 2018) and Parkinson's disease (Ferraz, Trippo, Dominguez, Santos, & Oliveira, 2017). Therefore, it can help in the prevention of falls (Mirelman, Maidan, Herman, Deutsch, Giladi, & Hausdorff, 2011) since it has shown that digital games increase adherence to a rehabilitation program after falling (Uzor & Baillie, 2014).

Physical exercise with conventional or technological devices, is one of the best therapies to raise the functionality of anyone who wants to grow, mature, and have healthy ageing. For example, some studies (Chao, Scherer, Wu, Lucke, & Montgomery, 2013) demonstrated that regular exercise using exergames is a potentially effective approach to improve physical function for assisted living facilities residents as well as cognitive function (Zhang & Kaufman, 2016). Nowadays, there is growing interest in using videogames for improving health and quality of life in older people. Therefore, more research needs to be conducted to increase the knowledge about their benefit in this population. Consequently, the aim of this study was to measure the usefulness of incorporating videogames as a physical activity training program for women above 60 years old.

Methods

Design

The used design corresponds to a randomized controlled trial with three groups: two experimental groups and a control group. The control group (CG) made pre-test and post-test, without any intervention of program application. Experimental group 1 (EG1) conducted an aerobic resistance and proprioception training program. Besides, they did a multimedia interaction viso-motor activity (Wii console). Experimental group 2 (EG2) only conducted the training of aerobic resistance and proprioception program.

Participants

We recruited 52 women. After adaptation program, 43 women remained in our study (age=67.74 ± 5.03 years; weight = 71.80 ± 11.62 kg; BMI = 31.39 ± 4.58 Kg/m^2). The CG consists of 11 participants (age = 67.09 ± 6.25 years), the EG1 was composed of 16 subjects (age = 66.94 ± 4.14 years). The EG2 consists of 16 participants (age = 69.00 ± 4.99 years).

After receiving detailed information on the objectives and procedure, participants provided written informed consent in accordance with the ethical standards established the World Medical Association's Declaration of Helsinki (2013). It was conducted according to the European Community's Guidelines for good clinical practice (Doc. 111/3976/88; July 1990) and the Spanish legal framework for clinical research on humans (Real Decreto 561/1993 on clinical trials).

Procedure

The participants conducted an adaptation program to familiarize and to learn how to use the technological devices. It took 3 sessions in a week (non-consecutive days). Three groups randomly composed of seventeen, seventeen, and eighteen subjects (52 subjects) were established. The first group practiced with static bikes for twenty minutes. The second group did balance exercises for twenty minutes. The third group practiced with the video game console for another twenty minutes. They changed the activity after the established practice time, passing through the three stations.

Data Analysis

Experimental groups were defined following a personal preference for practice or not with the Wii console. Both groups were formed following a balance in relation to the number of subjects and their baseline characteristics. We performed chi-square test to establish the homogeneity of groups (age: p=.490; weight: p=.198; BMI: p=.132; fat mass: p=.250; lean mass: p=.193). In addition, we conducted ANOVA to confirm the homogeneity of groups. We obtained that there are no significant differences among groups, thus the final allocation of the participants does not have an influence on the final results.

Initial and Final Evaluation

Initial and final evaluations were carried out sequentially during the same session to all participants. We used a size meter model Sayol (SL, Barcelona) to measure their height. Body composition was measured by bioelectrical impedance technique (Kyle et al., 2004; Perissinotto, Pisent, Sergi, Grigoletto, & Enzi, 2002) and Tanita device (SC330). We conducted the monopodal balance test to measure the balance (with and without vision). Eye-hand coordination (manual agility) was measured using the plates of the dominant hand punching test (Camiña, Cancela, & Romo, 2001). The strength of the lower limbs was evaluated with counter movement jump (CMJ) test. We used OptoGait system (Microgate, Bolzano, Italy) to record the data. It has been used in similar studies (Dionyssiotis, Galanos, Michas, & Lyritis, 2009). Finally, we measure the cardiorespiratory resistance using the walking test (Camiña et al., 2001) and we recorded the heart rate of the participants throughout the test to check the physical condition. For that, we used the sensors of the static bike Mundial Silver Línea Tentabla to determinate the VO_2máx.

Practical Session

The experimental treatment was carried out for 12 weeks (3 sessions a week each group). The sessions for EG2 lasted 40 minutes, whereas for EG1 the sessions lasted 60 minutes, since this group performed an additional activity with the Wii console. Both groups performed a standard warm-up (10 minutes). In both cases it was established a work routine that responds to a progression in intensity.

Every group performed 20 minutes at each station (static bike or balance). Once, the time was completed, EG2 ended their session. Whilst, EG1 moved to the third station. On it, they had to play with a video game console (Wii). They played a tennis video game (video game Wii Sport, tennis) in couples (1 versus 1 modality) for 20 minutes.

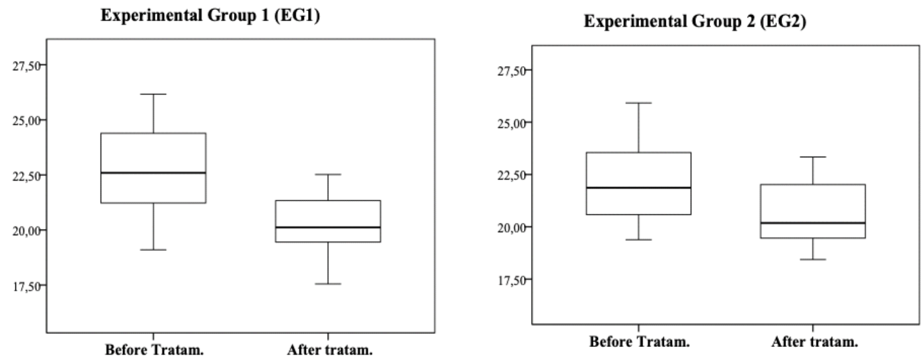

Figure 1. Time spent in cardio-respiratory resistance before and after the treatment in EG1 and EG2.

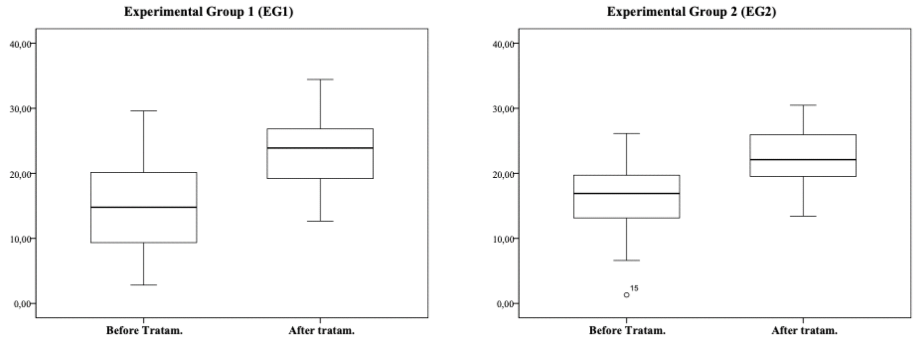

Figure 2. VO$_2$máx. in cardio-respiratory resistance before and after the treatment in EG1 and EG2.

Results

Table 1 presents the results obtained after the exercise program. We found significant differences in the monopodal static balance variable with vision in the EG1 (p=.008), and EG2 (p=.062). Also, significant differences were found for balance without vision in EG1 (p=.001). However, we did not find significant differences in EG2 (p=.508) for this variable. Regarding the manual grip, we found significant differences in no dominant hand isometric maximum strength variable in EG1 (p=.02), and EG2 (p= .018).

Concerning the time required to complete the gait test, we found significant differences in both groups (p<.001). Notice that EG1 got a greater time reduction than EG2. About VO$_2$max, we found significant differences in EG1 and EG2 (p<.001) (Figure 1 and 2).

We did not find significant differences in body weight in EG1 (p=.178). Regarding to fat mass, significant differences were found (p=.048). Lean mass did not show significant differences (p=.183). Concerning to BMI, we did not find significant differences (p=.116) in EG1. We found significant differences in EG2 for body weight variable (p=.017). Also, significant difference in fat mass was found (p=.008). In addition, a significant difference in BMI (p=.006) was found.

We apply ANOVA test to analyse differences between groups (table 2). We have found significant

Table 2.
ANOVA with factor "group" in the post-treatment phase. Post hoc analysis.

Variable	ANOVA (Sig.)	Multiple comparisons. Post hoc analysis			
		Group *vs* Group	Sig.	CI 95% difference of means	
				Lower limit	Upper limit
BWV	<.001*	CG *vs* EG1	<.001*	2.39	9.13
		CG *vs* EG2	0.013*	0.76	7.50
		EG1 *vs* EG2	0.406	-4.67	1.42
BwV	0.002*	CG *vs* EG1	0.003*	1.38	7.86
		CG *vs* EG2	0.426	-1.56	4.92
		EG1 *vs* EG2	0.049*	-5.86	-0.01
MOC	0.006*	CG *vs* EG1	0.021*	0.44	6.28
		CG *vs* EG2	0.966	-2.62	3.23
		EG1 *vs* EG2	0.020*	-5.70	-0.42
DHS (kg)	0.858	CG *vs* EG1	0.862	-4.27	2.76
		CG *vs* EG2	0.970	-3.86	3.17
		EG1 *vs* EG2	0.947	-2.76	3.58
NDHS (kg)	0.384	CG *vs* EG1	0.412	-5.28	1.62
		CG *vs* EG2	0.546	-4.96	1.95
		EG1 *vs* EG2	0.965	-2.79	3.44
CMJ (cm)	0.781	CG *vs* EG1	0.789	-0.04	0.03
		CG *vs* EG2	0.873	-0.04	0.03
		EG1 *vs* EG2	0.983	-0.03	0.03
Weight (kg)	0.843	CG *vs* EG1	0.905	-9.91	14.14
		CG *vs* EG2	0.851	-9.33	14.71
		EG1 *vs* EG2	0.991	-10.28	11.43
BMI (%)	0.881	CG *vs* EG1	0.936	-4.09	5.46
		CG *vs* EG2	0.884	-3.84	5.71
		EG1 *vs* EG2	0.989	-4.06	4.56
FM (kg)	0.829	CG *vs* EG1	0.873	-6.05	9.17
		CG *vs* EG2	0.851	-5.91	9.32
		EG1 *vs* EG2	0.999	-6.73	7.01
LM (kg)	0.855	CG *vs* EG1	0.955	-4.28	5.44
		CG *vs* EG2	0.856	-3.79	5.93
		EG1 *vs* EG2	0.961	-3.90	4.87
CR T (min)	<.001*	CG *vs* EG1	<.001*	1.03	3.96
		CG *vs* EG2	0.004*	0.58	3.52
		EG1 *vs* EG2	0.692	-1.77	0.87
CR VO$_2$max (ml/kg/min)	0.001*	CG *vs* EG1	<.001*	-13.99	-3.21
		CG *vs* EG2	0.007*	-12.46	-1.67
		EG1 *vs* EG2	0.727	-3.33	6.40

BWV: Balance with vision; BwV: Balance without vision; MOC: Manual oculus coordination; DHS: Dominant hand strength; NDHS: Non dominant hand; CMJ: jump with countermovement. Weight: Total body weight; BMI: Body mass index; FM: Fat mass; LM: Lean mass; RC. Time: Cardio-respiratory resistance. Time to complete gait test; RC. VO$_2$máx: Cardio-respiratory resistance. Maximum consumption of oxygen.

Table 1.
Comparison of means within each group for the pre-test and post-test phases.

	Control Group (CG)				Experimental Group 1 (EG1)				Experimental Group 2 (EG2)			
Variable	Pre-test Mean ± SD	Post-test Mean ±SD	p (sig)	95% confid. intervals	Pre-test Mean ±SD	Post-test Mean ±SD	p (sig)	95% confid. intervals	Pre test Mean ±SD	Post test Mean ±SD	p (sig)	95% confid. intervals
BWV	8.00 ±4.83	8.82 ±4.09	0.314	-2.54;0.90	5.50±4.15	3.06±3.38	0.008	0.73;4.14	6.06±4.07	4.69±2.82	0.062	-0.08;2.83
BwV	12.45±3.93	12.18±3.60	0.661	-1.07;1.62	10.63±4.59	7.56±3.43	0.001	1.41;4.72	11.38±5.06	10.50±2.80	0.508	-1.87;3.63
MOC	19.21±5.11	17.46±3.44	0.119	-0.53;4.01	13.80±3.01	14.11±2.53	0.340	-0.95;0.35	17.05±3.55	17.16±2.95	0.883	-1.72;1.49
DHS (kg)	19.73±3.76	20.90±3.18	0.157	-2.88;0.53	22.61±4.69	21.66±3.65	0.207	-0.58;2.48	22.24±3.36	21.24±3.63	0.092	-0.18;2.17
NDHS (kg)	17.27±3.42	17.93±3.36	0.310	-2.02;0.71	21.53±3.94	19.76±3.46	0.020	0.32;3.23	21.03±3.03	19.43±3.54	0.018	0.32;2.88
CMJ (cm)	0.07±0.04	0.07±0.04	0.146	-0.01;0.00	0.08±0.04	0.08±0.04	0.187	-0.02;0.00	0.08±0.03	0.08±0.03	0.212	-0.01;0.00
Weight (kg)	73.18±13.26	73.11±13.26	0.678	-0.31;0.45	71.50±11.87	70.99±12.4	0.178	-0.24;1.19	71.19±10.86	70.42±10.85	0.017	0.16;1.38
BMI (%)	32.4±5.23	32.28±5.25	0.090	-0.02;0.26	31.86±4.31	31.60±4.51	0.116	-0.07;0.58	31.69±4.66	31.35±4.75	0.006	0.11;0.57
FM (kg)	29.56±8.43	28.97±8.25	0.066	-0.05;1.21	28.24±7.61	27.41±7.61	0.048	0.01;1.64	28.33±7.68	27.27±7.25	0.008	0.32;1.80
LM (kg)	43.63±5.31	44.16±5.35	0.014	-0.94; -0.14	43.23±4.92	43.58±5.36	0.183	-0.88;0.18	42.86±3.63	43.09±3.96	0.497	-0.96;0.49
CRT (min)	22.49±1.23	22.64±1.47	0.244	-0.16;0.55	22.70±2.09	20.15±1.47	<.001	1.52;3.58	22.20±2.00	20.59±1.47	<.001	0.96;2.24
CR VO_2max (ml/kg/min)	15.87±4.98	14.93±5.36	0.097	-0.20;2.08	15.04±7.91	23.56±6.05	<.001	-11.85; -5.14	16.18±6.42	22.00±4.74	<.001	-7.52; -4.12

BWV: Balance with vision; BwV: Balance without vision; MOC: Manual oculus coordination; DHS: Dominant hand strength; NDHS: Non dominant hand; CMJ: Countermovement jump. Weight: Total body weight; BMI: Body mass index; FM: Fat mass; LM: Lean mass; RC. Time: Cardio-respiratory resistance. Time to complete gait test; RC. VO_2máx: Cardio-respiratory resistance. Maximum consumption of oxygen.

differences in monopodal balance with vision ($p<.001$); monopodal balance without vision ($p=.002$); oculus manual coordination ($p=.006$) time required to complete gait test ($p<.001$) and VO_2máx ($p=.001$).

Discussion

The study aimed to measure the usefulness of incorporating videogames as a physical activity training program for women above 60 years old. Our results show that a training program that adds the use of videogames to proprioceptive and aerobic resistance exercises can improve monopodal static balance, with and without vision. It is important for daily activities and is considered beneficial to prevent falls in women over 60 years.

It is important to note that there are a lot of variables which should be considered in a training program. Duration time program is an important variable to consider when we design a training program. There is previous research with shorter, equal, or greater experimental time (Flack et al., 2011). In our study, intervention time was enough to obtain significant differences in some variables. It would be desirable to increase it in order to know if a greater time training produces greater improvements in the variables analysed. It seems to happen in the longer-term interventions (Santanasto, Glynn, Newman, Taylor, Brooks, Goodpaster and Newman, 2011).

Intensity and volume are variables that can modify the final result during the intervention programs. A well-evaluated training program allows increasing workload and adapts to the participants the intensity and volume during the intervention. It can improve the quality of life, cognitive function, as well as the level of balance and flexibility (Chao, Scherer, Wu, Lucke, & Montgomery, 2013; Williams, Soiza, Jenkinson, & Stewart, 2010). In our study, EG1 and EG2 had the same intensity level during the training sessions. Thus, the significant differences that we found in the variables analysed are not due to changes in intensity during the training sessions. It should be noted that the workload volume was different since EG1 performed 20 minutes longer (playing videogames) than EG2 during the training sessions. Volume difference can be a limitation of our study since more time spent playing videogames can modify the final results. Future research needs to be conducted with the same volume workload so we can determine which experimental group obtains better results.

Concerning body composition, it seems that it takes at least 3 sessions per week to produce improvements. In addition, we can make caloric restriction during the intervention with physical exercise. It allows us to obtain significant differences in body composition with less than three weekly sessions (Santanasto et al., 2011). In regard to weight, BMI, and fat mass, EG2 showed significant differences. It is in concordance with previous research (van den Berg, Elders, De Zwart, & Burdorf, 2008). Noticed that lean mass did not increase in EG1 nor EG2. Nonetheless, it can be considered a positive result due to the increase of sarcopenia that occurs at these ages (Janssen, 2010; Lang, Streeper, Cawthon, Baldwin, Taaffe, & Harris, 2010).

Balance is essential to maintain a good level of capacity in ageing, due to the relationship between mobility, falls, and balance (Agmon, Perry, Phelan, Demiris & Nguyen, 2011; Blank et al., 2011; Meisler et al., 2011; Ruthig et al., 2007; Scheffer et al., 2007). Our results show that a proprioceptive training complemented with videogames, produces significant differences in monopodal balance with and without vision. Both groups got a decrease on the surface used by the free foot on the ground to maintain balance. In EG1, significant differences were obtained in balance (with and without vision). Whereas, EG2 had slight differences in balance without vision. The difference between groups may be due to the longer training time for visual perception that EG1 received.

It seems that the use of new technologies that involve training of visual perception improves the balance in older adults. It allows to avoid falls in this population (Cameirão et al., 2010; IJsselsteijn, Nap, De Kort, & Poels, 2007; Mirelman, Maidan, Herman, Deutsch, Giladi, & Hausdorff, 2011). It is confirmed in our research with the implementation of the program of intervention with the Wii console and the Wii Sports game.

According to eye-hand coordination, our results are in concordance with previous studies (Kosse & Maartenskliniek, 2011).The uses of exergames improve this capacity in EG1.

In relation to the handgrip isometric strength, we did not find significant differences. A reason for that could be the use of the dominant hand in everyday tasks. Therefore, is not necessary to implement a specific training program to keep the level of the force. Nonetheless, the results showed significant differences in the non-dominant hand. The participants did not a specific training program so the value of hand strength decreases due to the degenerative process that occurs at this age. This decline in strength is related to lower abilities, an increase of falls, as well as being a factor predictor of the difficulties of the elderly in their daily activities (Hernandez et al., 2010; Van den Berg, Elders, de Zwart, & Burdorf, 2008).

In cardio-respiratory resistance, we found significant differences in both groups compared with the control group. Both experimental groups decreasing the time spent to complete the task and increasing the VO2max value. VO2max is considered a sign of vitality in older adults. Also, it is related to their cognitive ability which can be reduced at these ages (Chakravarty et al., 2008; Fleg, J. L., Morrell, Bos, Brant, Talbot, Wright, & Lakatta, 2005; Van den Berg et al., 2008).

We did not find significant differences in some variables analysed in our study. A reason for that can be placed in the temporal difference of the treatment, the intensity and volume difference of the workload or the specific nature of the tasks performed.

In conclusion, joining a physical training program, including proprioceptive and aerobic resistance exercises result in a weight and BMI drop, and a VO2max improvement for older people. Additionally, should be noted that if the training program is completed with the use of exergames in videogame console, monopodal static balance improves, with and without vision. It is considered beneficial to prevent falls of elderly people.

Practical Application

Nowadays, it is necessary to emphasize that promote active ageing is an essential task to improve the quality of life of older adults. It generates many benefits such as the prevention of falls, early mortality decline, and higher rates of overall vitality in the population.

Exergames should be taken into account when designing a training program for people over 60 years of age. It can help improve physical capacities and neuromuscular aspects. In addition, exergames allow to break the technological gap between generations since older adults and their grandson/child could use videogames in their free time.

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